OBSERVATIONS

ON

THE BEST MEANS

OF

PROPELLING SHIPS.

BY

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TO THE

DIRECTORS

OF THE

NATIONAL INSTITUTION,

WASHINGTON.

GENTLEMEN,

The Author is induced to dedicate to you the following Observations on the best mode of Propelling Ships, convinced that, if he is correct in his opinions on this important subject, any advantages to society which may be derived from its introduction, will most effectually be developed, if approved of by the National Institution of Washington.

Gentlemen,

Your most obedient,

Humble servant,

THE AUTHOR.

NEW-YORK, 20*th January*, 1841.

INTRODUCTION.

PROMPTED by a sense of duty, and a desire to promote the interests of society, the author has been induced to devote much time to the consideration of the subject treated of in the accompanying observations, and to obtain the fullest information in his power. Until within the last few months he knew little on the subject, and being but imperfectly acquainted with nautical science, feels it necessary to apologize for placing the results of his inquiries before the public; but, moved by a deep sense of the importance of the subject to the progress of civilization and the useful arts, he could not refrain from doing his part to place it fairly before the world.

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ON THE BEST MEANS

OF

PROPELLING SHIPS AT SEA.

WHETHER we view this question in a scientific, commercial, or political point of view, it is one of the utmost importance to the interests of society. The defects of the paddle-wheel are so glaring, and its extreme inefficiency in adverse wind and heavy sea so fully established, that it becomes a duty in every one interested in the subject to perfect, if possible, a better kind of propeller. It is gratifying to know that the means are at hand, and only need a candid and impartial inquiry to be universally adopted; with this object in view, the following observations are submitted to public notice, in the hope that the subject may receive the attention it deserves.

Many substitutes for the paddle-wheel have been recommended, which need not be noticed, from the circumstance that they are not only inadequate, but, as compared with other inventions, useless. It will be sufficient to notice the most important, and to explain their respective advantages. Two of these

now occupy public attention — the Archimedean Screw, and the Ericsson Propeller; which, it may be well to observe, though entirely dissimilar, are too frequently confounded. To the former great attention is given, not on account of its novelty, but because it is supposed to possess great advantages over the paddle-wheel. Now it will be shown in the following pages, that, although there are some advantages arising from the introduction of the Archimedean screw, its disadvantages are of such magnitude, in a practical point of view, as to render the idea of its general introduction too visionary for serious contemplation.

An Archimedean screw consists of a single thread winding spirally round a shaft, as a centre, and terminating at any desired angle at its circumference. Attached to a steam-engine, and used as a propeller, an inclination of forty-five degrees would be the best, as every revolution would give the same progressive, or lateral, as it does rotatory, motion. But were a screw constructed with a thread terminating at this angle, the length would be three times its diameter; *i. e.* if the diameter be six feet, the length would be eighteen. A screw of such great length, however, applied to the dead wood of a ship, would be impracticable; hence the necessity of reducing it, as in the Archimedes. Now, in order to reduce its length, the angle of the thread must be reduced also; and to make up for this diminution of the angle, the *speed* of the screw must be pro-

portionably increased, to produce the desired progressive movement. Supposing the screw to be 7½ feet long, and 6 feet diameter, it must revolve 140 times per minute, equal to a velocity of 32 miles per hour, to produce a progressive or forward motion of only 10 miles. This excessive velocity, consequent on the shortening of the screw, will be attended with an immense waste of power, occasioned by the friction or adhesion of the water against the surface of the thread, it being an established fact in hydraulics, that the resistance produced by such friction or adhesion increases in the ratio of the squares of the velocities.

Besides this, there are other obvious losses of power, and objections which are insurmountable—

First.—A great loss consequent upon the receding of the water, allowed to be one-sixth of the whole power employed, but which is under-rated. The causes of this loss are evident. Every particle of water in contact with the surface of the screw, must remain until it passes off at the after part thereof; and during this necessary contact, a revolving motion is given to the water, which diminishes its effect as a resisting medium.

Second.—The power applied at the centre of the screw, and for some distance outwards, is rendered inefficient, having scarcely any other effect than that of giving a revolving motion to the water—a large portion of the thread being nearly parallel to the line of direction in which the ship moves.

Third.—The friction consequent upon the use of complicated and cumbrous gear-work, cog-wheels, band-drums, chains, &c., indispensable to produce the high velocity of the screw. The losses under this head, as compared with the paddle-wheel, are very considerable.

Fourth.—Although the screw acts entirely below the water, still the gear-work alluded to must be placed above the water, and is thereby completely exposed to an enemy's shot, since the requisite velocity cannot be obtained without the use of wheels, or band-drums, of very large diameter; for war purposes, therefore, the Archimedean screw is almost useless, and for ordinary purposes its utility is rendered questionable, unless some new form of steam-engine be resorted to, capable of working at a high velocity, but which ample experience has proved to be unattainable in practice.

Any propelling apparatus, to be practically useful, must have for the basis of its construction such a principle that the power applied to it will produce the greatest effect attainable with reference to the specific gravity of water, and it must admit of considerable variation in reference to the draught of water of the vessel to which it is applied; in both of these principal features, the former in particular, the Archimedes is quite defective. With regard to power and effect, it will be shown hereafter, there is an absolute loss of 46 horses in the Archimedes, occasioned by the enormous friction or adhesion

against the screw, together with the receding of the water. To give the reader an idea of the amount of power thus wasted, by the stated excessive velocity of the thread in going through the water, suppose the low speed of 8½ knots attained by the Archimedes, that is less than 10 statute miles per hour, say, for round number, 10 miles, equal to 880 feet per minute. Two different screws having been applied to the Archimedes during the early trials, one 7 feet in diameter and 8 feet long, and the other 6 feet in diameter and 7 feet 6 inches long, and the latter requiring the least speed of the two, the following calculations will be founded upon the dimensions thereof. The loss of speed being admitted to be one-sixth, it follows that for each revolution of the screw, the progress of the vessel, instead of being 7 feet 6 inches, (the length of the screw,) it will only be 6¼ feet; hence the number of revolutions requisite to produce 10 miles an hour, or 880 feet per minute, will be full 140 per minute. The diameter of the screw being 6 feet, and its length 7 feet 6 inches, with a thread of exactly one turn, it follows that the outer edge thereof will measure 20¼ feet in length; this number of 20¼ multiplied by the number of revolutions per minute, shows that the speed of the screw will be 2858 feet per minute, or nearly 48 feet per second; hence, in order to propel a vessel at a rate of *only* 10 miles per hour, a velocity of upwards of 32 miles per hour must be given to the screw!

That a large surface cannot be moved through the water at such an enormous speed without much resistance, any one will suppose; but the amount of the actual loss the reader would hardly credit. We have, however, accurate data for forming an estimate, by the known adhesion or friction of water against a given surface, at any given speed. Col. Beaufoy ascertained that a smooth surface, containing 50 square feet, met with the following resistance:

At	3	feet per second . . .	$1\frac{3}{5}$ lbs.
,,	6	,, ,, ...	$6\frac{1}{4}$,,
,,	9	,, ,, ...	$13\frac{3}{4}$,,
,,	12	,, ,, ...	$24\frac{1}{4}$,,

By inspecting these figures it becomes manifest that the resistances increase exactly as the square of the velocities; and therefore when the resistance at 12 feet per second is $24\frac{1}{4}$ lbs. it will be 380 lbs. at $47\frac{1}{2}$ feet per second, or $7\frac{1}{2}$ lbs. per square foot. Now, in the screw under consideration it will be found that the mean of the friction or adhesion against *both sides* of the thread will be very nearly equal to that offered to a surface of forty square feet moving at equal velocity to the outer edge of the thread; hence the adhesive resistance of 304 lbs. with a velocity of 2858 feet per minute, or 868,832 lbs., raised one foot high in a minute, (equal to $26\frac{3}{10}$ horses power) must be exerted by the moving force without producing any useful effect. The power of the engine being 90 horses, and the loss produced

by the receding of the water admitted to be one-sixth, or 15 horses, it follows that 41 horses power are wasted, to say nothing of the loss occasioned by the multiplying gear, and by the unfavourable action of the screw or blade towards the centre, before alluded to. The reader will, after this demonstration, understand why the speed attained has only been 8½ knots per hour in open water, with 90 horses power applied to a vessel of such beautiful lines as the Archimedes.

The explosion of the boilers of the Archimedes, with its lamentable consequences, may also be traced to the cause thus explained, viz. the great resistance produced by the excessive velocity of the screw; for, had not this *unlooked for* resistance operated, the power of the Archimedes' engines would have been ample to give the required speed, without raising the steam in the boilers above the ordinary and safe pressure.

THE ERICSSON PROPELLER.

THE leading feature of this propeller is, that it works entirely under water, and that its construction is such that it can be applied to all existing vessels without the least alteration in their structure.

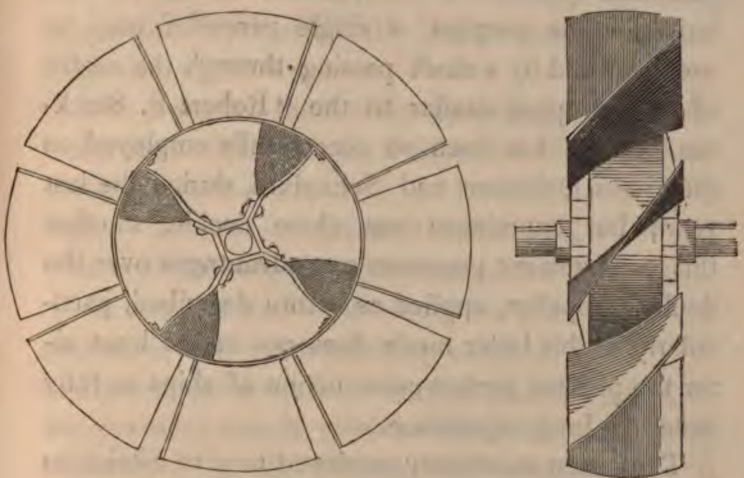
The next important feature is, that it will give any required speed to the vessel by a *direct* communication to the engine without the intervention of cog-wheels, bands, or any kind of multiplying gear, and also that it admits of being worked by an engine constructed to use steam *permanently* expansive.

Another important feature is, that the propeller being placed in the centre of motion, the heeling of the ship, under a heavy press of canvas, does not affect its efficiency; thus the power of wind and steam may be advantageously *combined*, and thereby a greater speed produced than has been hitherto attained.

DESCRIPTION.

This propeller consists of a short cylinder or thin broad hoop, made of wrought iron, to the outside circumference of which a series of thin plates are

attached, of a spiral or winding form; the hoop is supported by spokes, also of a winding form, attached to a shaft, made to revolve by suitable steam machinery.



The spiral plates on the outside of the hoop are placed at an angle of about 45 degrees.

When the propeller is caused to revolve, the vessel is urged forward by the resistance of the water against the spiral plates, produced by their oblique action, somewhat on the principle of sculling.

The shafts or axes of the propellers pass through the run or sternpart of the ship, and are supported at the extreme end by iron braces fastened to the sternpost.

The water is prevented from entering the ship round the shaft, where it passes through the run,

by means of a stuffing box, in a similar manner to the piston rod of a steam-engine.

When applied to ships already built, two propellers are used, one on each side of the sternpost; but when applied to steam vessels, or ships of war built for the purpose, a single propeller may be used, worked by a shaft passing through the centre of the sternpost, similar to the "Robert F. Stockton," which has been so successfully employed on the rivers Delaware and Schuylkill, during the last year; but experience can alone decide, whether this arrangement possesses any advantages over the double propeller, applied as before described, particularly as this latter mode does not in the least alter the present perfect construction of ships so fully tested by long experience.

The steam machinery employed to give motion to the propellers is fixed in the run of the ship, altogether under the lower deck, so that a very small portion of the stowage is taken away. The engines invented by Capt. Ericsson for this purpose are remarkably simple in their construction, and give a contrary movement to the propeller shafts, without the intervention of any kind of cog-wheel, or even the ordinary beams and guides used in marine-engines.

The moving parts of this engine being very few and light, admit of a much higher speed than would be deemed practicable in the common engine, a circumstance of much importance, as, from obvious

reasons, great reduction in the weight and space occupied by the engine will be the necessary consequence.

The shafts working close to the bottom of the ship also tend to simplify the machinery, doing away with the usual heavy framework of marine-engines.

The propeller shafts may be detached from the crank shaft of the engine simply by withdrawing two bolts, whenever the wind is favourable, or it is deemed advisable to proceed under canvas.

A powerful bilge-pump is attached to the engine, so constructed that it also may be used as a fire-engine, as well as for pumping the ship.

Having given a brief outline of this invention, our attention should next be directed to its leading advantages, which, for the sake of distinction, it may be well to arrange in the following order: —

1. It admits of a perfect combination of the powers of wind and steam.

2. It is productive of a great saving of power as compared with the paddle-wheel or Archimedean screw.

3. A great saving in weight and space of the engines employed for giving motion.

4. A great saving in the weight of the propellers, as compared with the paddle-wheels; the weight of the former being less than one-eighth of the weight of the latter, when of equal power; and the weight of the iron braces for supporting the propeller shafts,

being less than one-fortieth of the paddle beams and guard-houses, indispensable in ordinary steam-boats.

5. It may be confidently assumed that, upon an average, one-half the quantity of fuel requisite in a common steam vessel will be sufficient, when this propeller is applied, which great saving is effected by two principal causes; viz., the steam being always worked expansively, producing a saving of nearly 60 per cent; together with the circumstance that the immense waste of power attending the ordinary paddle-wheel in a rough sea, is completely obviated.

6. Great saving in stowage room, or increased capacity for carrying fuel, effected first by the diminished consumption, and secondly by the diminished weight and size of the engines and boilers.

7. The absence of all tremulous motion, in which respect the propeller is totally different from the paddle-wheel.

8. The propeller being placed several feet below the water-line, it is completely protected from gun-shot, and thereby particularly applicable for war purposes.

9. The great objection to the ordinary paddle-wheel, during severe winter, is entirely obviated, as the propeller is not affected by the ice.

There are several other minor advantages resulting from the use of the propeller, omitted in this

work, being obvious consequences of those already stated.

Having now noticed its general advantages, it will be proper in this place, to notice the application of the Ericsson propeller, to some of the most important objects, more in detail.

FIRST, with regard to *Merchant Ships.* — This branch of the subject being so much better understood and appreciated by the American public, (remarkable for acuteness in commercial matters,) the author prefers to cite the opinion of a leading New-York journal on this head: —

"*Revolution in Ocean Navigation.—American Steamers.*—The much desired combination of the powers of wind and steam for the navigation of the ocean, will, we have every reason to believe, soon be effected.

"Messrs. Russell and Stephen Glover, of this city, known for great knowledge and experience in all matters relating to navigation, are now applying Captain Ericsson's Ship-Propeller, to their fast sailing packet ship Clarion.

"The steam machinery employed to turn the shafts and propellers, is fixed in the run of the ship, abaft the mizen-mast, under the lower deck, so that scarcely any stowage room is taken away.

"The engines building for the Clarion will be equal to 70 horses power. The total weight of the whole machinery will not exceed 20 tons. These

engines are of a remarkably simple construction; the crank-shafts working close to the bottom of the ship, the heavy framework, indispensable in ordinary marine engines, is altogether dispensed with.

"A powerful pump will also be attached to the engines of the Clarion, which may be used either as a fire-engine or for pumping the ship.

"The consumption of fuel will not exceed four tons in twenty-four hours, owing to the economical mode of working the steam by expansion, which this propeller admits of at all times, whether the sea is rough or smooth. A blower being employed, the chimney will be very small, standing only twelve feet above deck."

* * * * *

"The practical results of having such a considerable independent power on board a ship need hardly be pointed out. On a lee-shore, or in a current, such a ship is always safe; in moderate head-winds or calms she proceeds steadily towards her destination; if she springs a leak there is the untiring steam power to keep her dry, with a force exceeding one hundred men; if struck by lightning, or her cargo ignited by spontaneous combustion, there is the same energetic power to extinguish the flames by throwing an unlimited quantity of water, but which is pumped back again as soon as it finds its way into the bilge. On making land, a ship provided with this propeller does not require the aid of a steam-tug; and even during the most severe

winter her propelling machinery will remain equally efficient, being placed several feet below the water-line, and thereby protected against ice, and freed from an impediment which renders common paddle-wheels quite useless during severe winter. To this may be added, that the pursuit of a hostile man-of-war, or a pirate, may be disregarded by a captain who has the good fortune of commanding a ship possessing such powerful means for effecting a prompt escape, independent of the capricious agency of the wind.

"The increased duty which will be performed by every ship provided with the Transversal Ship-Propeller, the great saving effected in pay and maintenance of the crew, the reduced cost in providing for passengers, saving of interest of capital invested in the ship, saving of the interest on a valuable cargo, &c. consequent on making short passages, are advantages which this novel application of steam as an auxiliary will effect, but the amount of which we shall leave to the experienced merchant to estimate. In conclusion, we hail the improvement which the Messrs. Glover are now introducing into our mercantile navy, as being one of national importance; and we predict, that if that success attend the Clarion, which there is every reason to anticipate, our splendid packet ships will soon resume the proud station which they occupied before the introduction of the British steamers; and we may ere long see American steam-packets constructed to

receive the *combined* efforts of wind and steam, far outstrip our rivals; thus again restoring us to that mastery of the waves which signalized our country before all others, previous to the introduction of the European steam-ships."

"*Steam Ship Clarion.*—We beg to correct your statement in Saturday's Herald respecting the application of steam power to our ship 'Clarion.' It is not the Archimedean screw that we are going to apply, but a propelling apparatus possessing far superior qualifications, viz. Capt. Ericsson's Ship Propeller, which has no other property in common with the screw of the experimental steam-boat Archimedes, than that *of working entirely under water.*

"Deeply interested in nautical commerce, we have watched with much attention the effects of the introduction of steam power for ocean navigation, and careflluy estimated the probable results of the application of steam to our unrivalled American packet ships, and we have arrived at the conclusion, that an auxiliary steam power, capable of propelling our ships at from seven to eight miles per hour in calm weather, will effect a revolution in commerce far greater and more beneficial than the introduction of steam-ships. With these views we have noticed with much interest the development of the invention, which we now are applying to the "Clarion." We were present at the first trial of this Ship-propeller in England, some time since, the

result of which, corroborated by further trials of a practical nature, places the success of the principle, to our minds, beyond a doubt.

"In endeavouring to introduce an improvement in navigation so much needed, and in the success of which so great an interest, both private and public, is at stake, we have been at some pains to ascertain the respective claims of the rival plans, and we find that there is so great a difference in the practical utility and economy of the two, as to leave no room for hesitation as to the preference.

"Russell E. Glover,
"Stephen E. Glover.

"New-York, Nov. 20, 1840."

(See Appendix D.)

Second, to *Ships-of-war*.—It is evident from what has been before stated, with regard to the construction of the Ericsson propeller, that it is a complete solution of the important problem which forms the greatest desideratum in naval warfare, viz., an apparatus the whole of which is placed at a considerable distance below the water-line, and capable of propelling the ship at any desirable velocity—and it becomes doubly important from the circumstance, that it may be applied to existing ships of war, without the least alteration in their structure; giving them a most decided advantage over all war-steamers as at present constructed. On this

particular application of the Ericsson propeller a leading New-York journal remarks as follows :—

*   *   *   *

"Another important advantage connected with this movement is, in case of a sudden war the city of New-York could produce in ninety days more war-steamers than all Europe combined. If all our splendid packet ships, such as the Roscius, Russell Glover, &c., had guns on board they would be vessels of war; and if the Ericsson Transversal Propeller were added, they would be converted into war-steamers. None of an enemy's shot could touch the machinery, as the whole is many feet below the surface of the water. Thus the United States can put to sea more steam fighting ships in ninety days than there are now afloat in Europe."

"Already we have shown that we can build war or commercial steamers equal to the English, and even superior. One large packet company are now making arrangements for constructing four steamships of two thousand tons each; the progress they have made we shall soon learn. And those enterprising merchants and captains, Stephen and Russell Glover, in conjunction with Captain Ericsson, a skilful engineer and man of science, are fitting up the Clarion with a transverse propeller, and steam-engines on a new construction." . . . . "Of the necessity and importance of all this, all can judge who look at the troubled state of the times; the border difficulties; the Caroline question; the boun-

dary troubles; the menacing tones of France; the war-mania of Mehemet Ali; and particularly the rapid strides which Great Britain is making for empire, not only in China, but all over the world. Let our public functionaries think of these things, and keep their eyes open."

Whale-fishery.—The advantages of the application of the Ericsson propeller are so evident, that any lengthened explanation on this point becomes unnecessary, since the present difficulties of chasing the whales, whether in calms or contrary winds would be entirely obviated, by the power possessed of proceeding in any direction at will—the scraps of the whales, it should be observed, will supply the fuel for working the steam-machinery.

Having said so much in favour of this important invention, justice to the public demands that none of its disadvantages should be overlooked, and in order that the reader may feel assured, there are no difficulties or weak points kept unnoticed in the back ground, this important duty of explaining the disadvantages of the Ericsson propeller, the author undertakes faithfully to perform, assuring the reader, that there are no others known to himself, or which, after mature deliberation with some of the first engineers of the day, have been suggested, than those which he is now about to explain.

A correspondent of the London Mechanics' Magazine has asked, "what sort of a figure one of the Transatlantic steamers would cut with a pro-

peller in her stern, when met by such gales as the Great Western and British Queen have to contend with?" This plainly shows that he has no correct knowledge whatever of the subject on which he volunteers to give such a decided opinion, for it is in this very instance, that a propeller, the principle of which is, that of working entirely under water, and thereby, as will be presently proved, not subjected to the disadvantages attending the paddle-wheel, from heavy sea and excessive immersion, will "show off" to the best advantage and "cut" the best figure.

The elaborate writings on the theory of the paddle-wheel, which have appeared in the late editions of Tredgold, and others, from time to time, render it unnecessary to enter upon any detailed statement of its powers and defects, more particularly since the Atlantic steam-packets have so fully established the fact, that for sea-going purposes, an immense waste of power attends this mode of propelling, and which, even in smooth water, under the most favourable circumstances, amounts to one-third of the power employed.

The Great Western steam-ship company, with three years' experience on the subject, having decided to hazard the substitution of the Archimedean screw, imperfect as it manifestly is, proves more completely than any profound philosophical argument, that the paddle-wheel is most defective.

An ordinary observer, who has been at sea in a

steamer, during a gale, must be convinced, that however perfect the paddle-wheel may be for rivers and smooth water, it is the most inefficient propeller for ocean navigation that can well be conceived, for, during a gale, the speed of the engines is generally reduced to one-half, so that an engine of 400 horses power is at once reduced to 200 horses; but even this power is by no means employed in urging the ship forward, fully one-half being wasted by the unfavourable action and deep immersion of the paddles. Thus, at a time when most power is wanted, we find an engine of 400 horses power reduced to that of 100 horses *effective* force. Besides this radical defect, there is the enormous waste of fuel, occasioned not only by the stated unfavourable action of the paddles, but also because the steam is never worked expansively in such circumstances: hence, the power expended, compared to the *useful* effect produced, will be in the ratio of nearly 3 to 1.

Now, let us consider what is likely to take place by substituting the Ericsson Propeller, constructed to work entirely under water. The immediate effect of the sea and the motion of the vessel on this propeller, will evidently be two-fold; first, the propeller will either be submitted to an excess of immersion, or secondly, it may in a very heavy sea, be lifted half out of water. In the first case no effect whatever on its speed or propelling power will be experienced, since its very principle is that of working entirely under water. Now, whether the top of the propeller

be immersed 4 feet or 10 feet in the water, can make no difference, the specific gravity of the fluid being (in a practical point of view) the same in both cases; thus, unlike the paddle-wheel, which loses its efficiency, and occasions an enormous loss of power when *deeply* immersed, the propeller continues uniformly effective at any degree of excessive immersion, whilst, from obvious reasons, that increased immersion can in no manner be attended with waste of power. It is also worthy of notice that the excess of immersion of the paddle-wheel, so injurious, is not only produced by heavy sea, but also by the heeling as well as the rolling of the ship: these latter causes producing no effect whatever on the Ericsson Propeller, in consequence of its revolving on the longitudinal axis of the vessel.

With regard to the ascending motion, it will be seen that when the propeller is lifted half out of water, its force to urge the ship forward will not be reduced, for as soon as the resistance of the water against the spiral planes becomes less, by the diminished surface presented, the *speed* of the propeller will *increase* until a resistance is established equal to the moving force: the practical effect therefore of the reduced immersion *will be an increase in the speed of the engines;* but this increase will not be very considerable, for the resistance of the water against the spiral planes is not in a direct ratio, but will increase as the square of the velocity increases.

Experiments, made to ascertain the actual speed

of a vessel fitted with the propeller compared to the progressive motion of the spiral planes, prove that the difference does not amount to 10 per cent. Thus, supposing the propeller to be half out of water, it will unquestionably continue to urge the vessel forward with undiminished force; but there will be an increased speed of the engines in the ratio of 4 to 3 nearly. Careful observation however of the motion of a vessel at sea has established the fact, that a propeller, the top of which is placed below the surface of the water to a depth equal to one-fourth the draught of water of such vessel, will not be kept half out of water for more than one-fourth part of the whole time, thus reducing the apparent loss of 25 per cent to only 6 per cent. This fact, contrasted with what has been before stated respecting the immense loss attending ordinary paddle-wheels, will give the very best idea as to "what sort of figure" a Transatlantic steamer will ere long "cut" with the Ericsson Propeller in her stern. To this add the effect of a stiff breeze on the beam of a ship, carrying a heavy press of canvas, fitted with the propeller, and compare the result, either in point of speed or saving of fuel, to that attending a common steam-vessel, which in similar circumstances would have the lee paddle half under water.

The next important objection to that of the constant variation in the immersion of the propeller alluded to, produced chiefly by the pitching of the vessel, is the "drag," or retarding effect occasioned by the body

of the propeller, in its passage through the water in the direction of the ship. This retardation, it will be seen, is by no means so great as would at first appear, for it is the sectional dimensions of the hoop, with its series of spiral planes, spokes, and central parts, which determine this resistance; but these being exceedingly small, the resistance will, of course, be very inconsiderable. A calculation, founded on the actual dimensions of the "Clarion" propellers, will set this supposed great objection completely at rest. The hoop being 3 feet 6 inches in diameter, and $\frac{1}{\ }$ inch thick, it will present 61 square inches sectional surface; the spiral planes, eight in number, being 18 inches deep, $\frac{3}{8}$ of an inch thick, will together present 77 square inches; the spokes will present 80 square inches; the central part 64 square inches—in all 282 square inches, or not quite 2 square feet. The braces attached to the stern-post for supporting the propellers, each 1 inch thick, present together $1\frac{1}{3}$ square foot; thus the whole sectional surface to be "dragged" through the water, and which unquestionably produces wasteful resistance, amounts only to $5\frac{1}{3}$ square feet; in addition to this, it should be stated that the various parts named do not present flat faces and square corners, but are made very tapering, or brought to a sharp edge, fore and aft; hence, in order to arrive at an accurate estimate of the retarding effect produced by their passage through the water, we have simply to compare their sectional area, $5\frac{1}{3}$

square feet, to the sectional area of the "Clarion" midship action of 240 square feet, and also their superficial measurement, 280 square feet, to that of the ship, about 5000 square feet; the former amounting to one-45th part, and the latter to one-18th part, it will be seen that the elements of resistance of the propeller, compared to those of the ship, do not amount to 3 per cent.; and thus it will be readily conceded that the power requisite to overcome the "drag," or retarding effect of the propeller, will only amount to 3 per cent. of that requisite to propel the ship at any given speed.

The oblique action next claims our serious consideration. The abstruse calculations and contradictory theories offered on this subject by some eminent philosophers and mathematicians induces the author not to enter on the theory of the Ericsson Propeller, convinced that the reader will prefer the result of practice to the most elaborate mathematical demonstration; he therefore simply begs to refer to the annexed statement (see Appendix A.), showing the actual results of trials instituted for the express purpose of testing practically the effect of this propeller; and which experiments, it will be seen, have been conducted in the presence of a great number of gentlemen known to possess much scientific and practical knowledge, and therefore may be confidently relied upon.

It has been stated as an objection to this propeller, that it will be quickly destroyed by the salt water and

the galvanic influence produced by the vicinity of the copper sheathing of the ship. These objections might at once be removed by substituting copper for iron in the manufacture of the propeller: but the supposed difficulties are more easily obviated, by attaching zinc plates to the propeller.

The weight of the propeller, suspended as it is, at the extreme point of the ship's stern, has been supposed by many to be very injurious, and likely to "rack the stern;" this objection, however, becomes quite insignificant, on considering that each propeller for the "Clarion" only weighs 900 lbs. As to the effect of the sea on the propeller, produced during pitching, we have only to reflect that the action on the hoop is greatly diminished by the roundness of its form, to say nothing of its very small diameter. Respecting the action on the spiral plates themselves, it is evident, from their angular position and extreme thinness, that they will be exposed to quite an inconsiderable pressure. The pressure of the water against the under side of the shaft, during the descending motion of the ship's stern, will not be sufficiently great to bear up the shaft, were it even less than one half of its actual weight, however violent the pitching may be.

Philosophical arguments may fail, after all, to convince the public of the truth of the foregoing remarks; reference is therefore again made to practice and experience. About two years ago an iron

steamer was constructed in London with Captain Ericsson's Propeller, which, after several trials, was sent to America by its owner, Captain Robert F. Stockton of the United States Navy, a gentleman so well known for high attainments in his profession. This iron boat has been used as a tug in the Schuylkill and Delaware rivers with the most perfect success. Her remarkable performances on the River Thames, previous to her departure, are detailed in the Appendix, A., to which may be added, that at the commencement of the last month she towed four laden barges from Bordentown to Philadelphia, through dense masses of floating ice, completely establishing that the propeller is not in the least impeded by severe frost, and in this respect possesses a singular superiority over the paddle-wheel.

The valuable experience thus gained as to this propeller was not likely to be overlooked by the United States government, nor by the thinking portion of the community; consequently the greatest interest has been evinced, and the result has been what might naturally be expected from enlightened minds. The subject has been fully considered by the Navy Department, and the Commissioners have recommended to Congress the propriety of immediately adopting the Ericsson Propeller, by building a war steamer forthwith upon this plan.

The Navy Commissioners, in their well-considered recommendation, in which they allude to the

striking advantages attending the Ericsson engine and propeller, conclude with the following sentence:

"The rapid increase of sea steamers of war in other countries renders it indispensable to the security of our own shores that early measures should be taken to increase this part of our naval force, and that all reasonable measures should be adopted to ascertain the best arrangements, not only for securing their efficiency when on our own coasts, but also for distant and more general cruising service."—See Appendix, B.

To prove that the commercial interests are perfectly alive to the importance of the experience alluded to, Messrs. Russell and Stephen Glover, of New York, known for long practical knowledge in all matters relating to navigation and commerce, have applied the Ericsson Propeller to their fine packet ship the "Clarion," and are about to introduce it extensively into the mercantile navy.

The author would not have urged this matter so zealously to the consideration of the public, but that he is aware how reluctantly any improvements, however good, are appreciated and adopted; or if appreciated, how much they are opposed by private interests, and too frequently their important features pilfered by public bodies, who have neither the justice to remunerate, nor the liberality to acknowledge from whence they derive the information by which often originally defective plans are rendered useful and lucrative.

Independent of what has been stated in the preceding pages, it is no small recommendation to know, that this vast improvement in navigation is the production of Captain Ericsson, known to be an engineer of the highest standing in his profession, and acknowledged even by his opponents to be a man of great theoretical and practical knowledge, and that the propeller and engine, which he has presented to the world, has occupied his best attention for several years.

It is not possible to conceive an improvement more important than that which has been explained by the foregoing remarks. To facilitate commerce and friendly intercourse between nations, and, as a consequence, promote the cause of civilization, are objects worthy of the philanthropist and statesman; and such results cannot fail to attend the introduction of the improvements treated of in the preceding pages: with that object in view, they are respectfully submitted to public attention.

REPORTS BY CAPT. CHAPPELL, R.N.

Since the first edition of the foregoing observations was published, a friend handed to me "The Reports relative to Smith's Patent Screw Propeller, as used on board the Archimedes steam vessel in various trials with Her Majesty's steam-packet Widgeon, and subsequently in a circumnavigation of Great Britain; to which are subjoined opinions on the same subject, conveyed in letters from many distinguished persons, &c.—By Captain Edward Chappell, R. N., thirteen years superintendent of Her Majesty's steam-packets at Milford and Liverpool."

The numerous inaccuracies in these reports, written evidently for the express purpose of recommending the Archimedean screw, and apparently with a view to conceal its *deficiencies*, are not only surprising, but are of serious moment. It is my intention, shortly, to publish a complete *exposé* of these inaccuracies; still I cannot refrain from adverting to a few leading points.

Although the Archimedean screw works entirely under water, still the *steam machinery* necessary to work it is as much exposed as in ordinary steam-vessels; and in addition to which the complicated wheel-work, for giving the requisite high velocity to

the screw, is not only placed above water line, but is partly *above deck.* Is it not matter for surprise then, that Captain Chappell, in recommending the Archimedean screw so strenuously, should have omitted to notice these great defects, which confessedly are of such magnitude as to render the whole plan useless for war purposes?

My surprise, however, on this point, was lessened in finding, that in head No. 1, of Captain Chappell's report, where his object appears to be to extol the *small dimensions* of the screw of the "Archimedes," he states its diameter to be 5 feet 9 inches; but in head No. 3, where his object evidently is to prove a very *large area* as compared with the area of the midship section, he states that the screw presents a surface of 33 square feet, besides the sectional area of the shaft! Now a simple calculation will prove, that in order to present that amount of surface, the screw represented in head No. 1 to be 5 feet 9 inches, *must be* 6 feet 6 inches in diameter!

Neither can I refrain from animadverting on the gratuitous assumption, that a contrivance so fanciful as "spiral gearing" will obviate the highly objectionable noise and tremulous motion of the cog-wheels; besides which, nothing can be more incorrect, than to compare the noiseless motion of such paddle wheels as those of the steam-frigate "Medea" to the very loud rumbling noise of the cog-wheels of the Archimedes; and which, as a matter of course, will increase with the wear of the cogs.

The unfair comparison between the Widgeon and the Archimedes, in which the "low masts and snug rig of the former are stated as advantages over the latter, cannot be overlooked. How came Captain Chappell to forget, that the Widgeon had paddle-boxes, increasing her beam some twenty feet more than the Archimedes, and projecting some six or eight feet above deck, thus doubling her sectional area exposed to the wind?

If other proofs were wanting to show the great inaccuracy of Captain Chappell's statements, it need only be pointed out, that in head No. 2 he states that the angle of the thread of the screw used in the Archimedes is 45 degrees, and that the number of the revolutions given to it amounted ordinarily to 138⅝ per minute. Let us see if this statement can be true.

The diameter of the screw is stated to be 5 feet 9 inches, hence the circumference will be precisely 18 feet. Now, since the angle is 45°, it follows that the progressive movement of the screw must be 18 feet for each revolution, and therefore that the progressive movement during one minute, (with 138⅝ turns) will be 2495 feet or upwards of 28 miles per hour, while the speed of the ship at no time exceeded ten miles. This statement therefore must be untrue; or, the asserted "slip" of only one-sixth is vastly under-rated.

A most important omission on the part of Captain Chappell yet remains to be noticed; viz., in making

his statement of the "*slip* and *loss of power*," he altogether passes over the latter. Now what can be more uncandid than that of not at all adverting to the great waste of power which must necessarily be occasioned by the friction or adhesion of the water against the two sides or surfaces of the thread, when it is considered that its speed towards the outer edge amounts to upwards of thirty miles per hour?

The great loss of power thus attending the use of the Archimedean screw, Captain Chappell was bound to point out, in a report professedly drawn up for the information of the public.

Since it is impossible to attribute to a gentleman of Captain Chappell's high character any intentional mis-statement, the author has not the remotest intention of imputing improper motives to that gentleman; at the same time he cannot refrain from expressing his unfeigned regret that Captain Chappell should have hazarded such decided opinions on a subject of vast importance, on which he evidently is not correctly informed.

ALEXANDER S. BYRNE.

APPENDIX.

A.

Extract from the "Mechanics' Magazine."

"We are now gratified in giving the result of some of her first experiments on the Thames. On Saturday week she was on the river with a party of about thirty gentlemen, invited to witness her performance, all of whom were quite astonished at her speed, nine miles being run, *with the tide*, in 35 minutes. Suppose 2½ miles allowance for the tide, there would be left full 12 miles an hour for the speed of the boat. But her triumphant experiment was made on Wednesday last, when she was put to the task she was designed for, showing her power for towing.

No. 1. Neptune, 15 feet beam, 4 feet 6 inches draught.
2. Joseph, 15 feet 7 inches beam, 4 feet 6 inches draught.
3. Ugis, 13 feet 4 inches beam, 4 feet draught.
4. Mary, 15 feet 2 inches beam, 4 feet 6 inches draught.

"Four loaded coal barges, of the dimensions and draught as described above, were made fast to the Robert F. Stockton, making, in all, 59 feet 1 inch beam, with square ends and upright sides, besides the steamer. All ridiculed the idea of attempting, with so small a boat, to tow such an immense, ugly mass, and the coal-heavers swore they would 'eat her if she moved them at all.' In less than one minute from the time of the starting of the engine, it was at the speed of 49 revolutions in a minute, and actually towed the whole 1 *measured mile in* 11 *minutes*, the water being perfectly still. The difference of speed between the propellers and the body moved being but 22 per cent., while the loss of power with wheels over the side, in the best constructed boats, running light, is allowed, both in theory and practice, to be 33⅓.

"Further experiments will, doubtless, be made, the results of which we shall take great pleasure in laying before the public; and in the meantime we venture to predict, that, for canal and ocean navigation Ericsson's Propeller is destined to supersede every other application of the power of steam."

From the "Times."

"It is a fact requiring no demonstration, that almost incalculable advantages would be derived from steam navigation if the present paddle-wheel were of such a nature as not to be retarded, and not to waste the steam power at sea in rough weather, or during the heeling of the vessel produced by the pressure of sails, in using that cheap auxiliary, the wind.

It is admitted, that the loss of power in the best constructed paddle-wheels, arising from their unequal immersion, from the angle of incidence at which the paddle strikes the surface and from the receding of the water, is about one-third. It is also a fact readily admitted, on considering the defects alluded to, that no material improvement can be effected unless that mode of applying the power is superseded by some propelling apparatus capable of acting with full efficacy when wholly under water as well as when partially immersed; in other words, a propeller which, under all circumstances, is capable of imparting an equal force to the vessel while subjected to sudden or gradual variations in the draft of water, whether produced by a heavy sea, pressure of sails, or by increase or diminution of cargo. These conditions are fulfilled by Capt. Ericsson's Propeller, which may be briefly described as consisting of two wheels of wrought iron, formed by a series of spiral plates, rivetted to narrow cylinders of the same material, which are connected by radiating spiral arms to the centre. These wheels are attached to shafts (the one to which the inner wheel is fixed being hollow) passing through the stern of the vessel, and revolving to opposite directions, each series of plates being so placed on the cylinders.

"The result of a variety of trials prove, that great saving in time and expenditure ensue; we, therefore, anticipate important changes in steam navigation from its introduction and use.

"The great power exhibited, during the early trials of this propeller, about eighteen months since, induced some American canal proprietors to order an iron steam boat, with a 50 horse engine, to be fitted with the new propeller. The small iron steamer, called the Robert F. Stockton, has lately arrived in the Thames, from Liverpool, and will shortly proceed to the United States: her dimensions are 70 feet in length on deck, and 10 feet beam. A variety of experiments have been made in presence of several scientific and practical men, who consider the success to be perfect. Although constructed for towing purposes only, this boat has frequently gone at the rate of 12 miles an hour. As to her power as a tug, we are informed, that, on Tuesday last, January 29, she towed the American packet ship, Toronto, from Blackwall to the lower point of Woolwich, a distance of 3½ miles, in 40 minutes, against the flood tide, then running from 2 to 2½ miles; thus towing her through the water at the rate of upwards of 6 miles an hour. The Toronto is 650 tons burthen, she measures 32 feet beam, and drew, at the time of trial, 16 feet 9 inches. Thus presenting a sectional area of more than 460 square feet. Now, the fact of this body having been moved at a rate of upwards of 6 miles an hour, by a propeller, or piece of mechanism measuring only 6 feet 4 inches in diameter, and occupying less than 3 feet, is one which, scientifically considered, is interesting in the extreme, and, in a practical or commercial point of view, is of immense importance."

And again, from the same journal:

"The experimental iron steamboat Robert F. Stockton, constructed for testing Captain Ericsson's Propeller, which we noticed some time since, being on the eve of departure for the United States, at the request of a number of scientific gentlemen who were desirous of witnessing her performance, the proprietor consented to another trial being made, and, on Saturday last, a large party was invited for this purpose. Among those present were Major-General Sir John Burgoin, Chairman of the Board of Public Works, and Commissioner of Steam Navigation, &c., Ireland; Major Robe, of the Royal Engineers; Mr. James Perry, of Dublin, lately concerned in canal navigation; Messrs. Vignolles, Delafield, Reid, Napier, and Thomas; several distinguished Swedish naval officers; Captain Stockton, of the United States Navy; Mr. Ogden, Consul of the United States, at Liverpool; Mr. Young, an American civil engineer, &c. Some thirty gentlemen were present, and the result of the trial gave universal satisfaction.

"One of our correspondents having before described the construction of the new propeller, we will now more particularly direct attention to the effect produced during the trial, which appeared quite conclusive as to the success of this important improvement in steam navigation. The distance from the West India South dock to a point opposite Woolwich church, and back, measuring 37,000 feet, was passed in 45 minutes precisely, (21 minutes with, and 24 against the tide,) the boat towing at the same time a heavy city barge on the one side, a large wherry on the other, and another wherry astern. The speed of the engine being repeatedly timed by one of the gentlemen present, Mr. Young, an intelligent American engineer, it was found to average 66 revolutions per minute, or 2970 during the 45 minutes. The inventor demonstrated, by accurate working drawings, that the spiral planes of the propeller are set at such an angle that, had the resistance of the water *been perfect*, the progress of the boat could only have been 13 2-10ths feet at each revolution, or 39,204 feet during the time, instead of 37,000 actually performed, thus showing a loss of less than 6 per cent. Respecting the engines for working the propeller, it was oberved, that they may be made *much stronger* and *more compact* than ordinary marine engines, in consequence of the power being applied *directly* to the shaft which works very near the bottom; this, for sea-going vessels, will be very important, and their original cost must be considerably *reduced*, as all the paraphernalia of shafts, wheels, wheel-guards, &c., will be dispensed with. We were struck with the *great regularity* of the motion, *not the slightest jar being perceptible*. The engines consist of two cylinders 16 inches in diameter, with 18 inches stroke, and are worked by steam, of a pressure varying from 35lbs. to 55lbs. to the square inch; their construction is extremely simple, and evinces a knowledge of steam machinery in the inventor which is calculated to give additional confidence in the success of his

propeller in all the varieties of its application for the canal, river, or ocean navigation."

It will be seen, that, in her first experiment, towing four heavy laden coal barges at the rate of 5½ miles the hour, the difference of speed between her propeller and the mass moved was only 22 per cent. Her ordinary speed, running light, was proved, to the satisfaction of a large party of scientific gentlemen who witnessed her performance, to be between eleven and twelve miles an hour.

In her second experiment she towed the packet-ship Toronto upwards of six miles an hour. The speed of her engines is not given in this trial; but the loss must, necessarily, have been less than in the first. But, in the third, all the data are given by which it may be accurately estimated. She had a heavy city barge, in which thirty persons might sit comfortably under a standing awning, lashed on one side, a large wherry on the other, and another wherry towing astern—with these obstructions she ran, by *measured distances*, upwards of 9 miles an hour, through the water, independent of the tide, and her loss of power was less than 6 per cent. The revolutions of her propeller, it will be seen, were 66 in a minute, and her progressive motion (supposing a perfect resistance) could only have been 13 2-10ths feet.

The loss, in well-constructed side wheels, is admitted to be 33⅓ per cent.
The loss of the Archimedes screw running light . . 25 "
The loss of Ericsson's Propeller, towing at the rate of
5½ miles the hour . . . . 22 "
Ditto, running light, less than . . . . . 6 "

These are not matters of opinion; they are demonstrated facts.

B.

Extract from the Report of the Secretary of the Navy to the President of the United States, 4th December, 1840.

It is also considered desirable not only to complete the two steamers now building, but to commence another steamer, to be propelled by Ericsson's propeller and other new arrangements of the working cylinders, as proposed by Captain Stockton of the navy. As only five of the six vessels which were authorised by the act of the 3d of March, 1837, have been built, it is believed that the sixth may be constructed to test the efficiency of this mode of propelling vessels, by comparison with the ordinary mode, without any deviation from the spirit of that law, which merely limits the extent of the armament of the vessels.

The department, as you may recollect, were only prevented from including this in the estimates for 1840, by the supposed necessity of limiting the estimates to a certain amount.

The apparent advantage which this mode of propelling steamers has over the common paddle-wheels, with respect to safety from shot, and in

the form and arrangements of the vessels for sailing purposes, renders it, in the opinion of the Board, desirable that the plan should now be subjected to the test of actual service, in a vessel which may be large enough to give it a fair and satisfactory trial, and yet no larger than is necessary for that purpose, until its advantages shall have been tested by actual service.

The rapid increase of sea-steamers of war in other countries renders it indispensable to the security of our own shores that early measures should be taken to increase this part of our naval force, and that all reasonable measures be adopted to ascertain the best arrangements, not only for securing their efficiency when on our own coasts, but also for distant and more general cruizing service.

C.

From the "New York Courier and Enquirer," 24*th Nov.* 1840.

Revolution in Ocean Navigation — American Steamers.—The much desired combination of the powers of wind and steam, for the navigation of the ocean, will, we have very reason to believe, soon be effected.

Messrs. Russell, and Stephen Glover, of this city, known for great knowledge and experience in all matters relating to navigation, are now applying Capt. Ericsson's Ship Propeller, to their fast sailing packet-ship Clarion. The leading feature of this propeller is, that of working entirely under water. It consists of two iron hoops to which a series of iron plates of a winding shape are attached,—these plates are fixed at an angle of about 45 degrees, and when caused to revolve, propel the ship by acting obliquely against the water, somewhat on the principle of sculling. The iron hoops, with their winding plates or paddles, are attached to shafts passing through the run of the ship, one on each side of the stern post.

The steam machinery employed to turn the shafts and propellers, is fixed in the run of the ship, abaft the mizen-mast, under the lower deck, so that scarcely any stowage room is taken away.

The engines building for the Clarion, will be equal to 70 horse power. The total weight of the whole machinery will not exceed 20 tons. These engines are of a remarkably simple construction; the crank shafts working close to the bottom of the ship, the heavy frame-work, indispensable in ordinary marine engines, is altogether dispensed with.

A powerful pump will also be attached to the engines of the Clarion, which may be used either as a fire-engine or for pumping the ship.

The consumption of fuel will not exceed four tons in twenty-four hours, owing to the economical mode of working the steam by expansion, which this propeller admits of, at all times, whether the sea is

rough or smooth. The blower being employed, the chimney will be very small, standing only twelve feet above deck.

Whenever the wind is favourable, it is intended not to use the steam power, in which case the propeller shafts will be detached from the engines, that being effected by simply drawing two bolts. An accurate estimate of the resistance offered by the propellers in revolving freely by the motion of the ship, has established the fact that their drag or retarding effect will not diminish the speed of the ship more than 5 per cent, whenever that speed exceeds 10 miles per hour.

The practical results of having such a considerable independent power on board a ship, need hardly be pointed out. On a lee-shore, or in a current, such a ship is always safe; in moderate head winds or calms she proceeds steadily towards her destination; if she springs a leak, there is the untiring steam power to keep her dry, with a force exceeding one hundred men; if struck by lightning, or her cargo ignited by spontaneous combustion, there is the same energetic power to extinguish the flames by throwing an unlimited quantity of water, but which is pumped back again as soon as it finds its way into the bilge. On making land, a ship provided with this propeller does not require the aid of a steam tug, and even during the most severe winter, her propelling machinery will remain equally efficient, being placed several feet below water line, and thereby protected against ice, and free from an impediment which renders common paddle wheels quite useless during severe winter. To this may be added, that the pursuit of a hostile man-of-war, or a pirate, may be disregarded by a captain who has the good fortune of commanding a ship possessing such powerful means for effecting a prompt escape, independent of the capricious agency of the wind.

The increased duty which will be performed by every ship provided with the Transversal Ship Propeller, the great saving effected in pay and maintenance of the crew, the reduced cost in providing for passengers, saving of interest of capital invested in the ship, saving of the interest on a valuable cargo, &c. consequent on making short passages, are advantages which this novel application of steam as an auxiliary will effect, but the amount of which we shall leave to the experienced merchant to estimate. In conclusion, we hail the improvement which the Messrs. Glover are now introducing into our mercantile navy, as being one of national importance; and we predict, that if that success attends the Clarion, which there is every reason to anticipate, our splendid packet-ships will soon resume the proud station which they occupied before the introduction of the British steamers; and we may ere long see American steam-packets constructed to receive the *combined* efforts of wind and steam, far outstrip our rivals; thus again restoring us to that mastery of the waves which signalized our country before all others previous to the introduction of the European steam-ships.

D.

From the "New York Herald" of November 23d, 1840.

We beg to correct your statement in Saturday's Herald, respecting the application of steam power to our ship "Clarion." It is not the Archimedean screw that we are going to apply, but a propelling apparatus possessing far superior qualifications, viz., Captain Ericsson's Ship-Propeller, which has no other property in common with the screw of the experimental steamboat Archimedes, than that of *working entirely under water.*

Deeply interested in nautical commerce, we have watched with much attention the effects of the introduction of steam power for ocean navigation; and carefully estimated the probable results of the application of steam to our unrivalled American packet ships, and we have arrived at the conclusion that an auxiliary steam power, capable of propelling our ships at from seven to eight miles per hour in calm weather, will effect a revolution in commerce far greater and more beneficial than the introduction of steam ships. With these views we have noticed with much interest the developement of the invention, which we now are applying to the Clarion. We were present at the first trials of this ship propeller in England, some time since, the result of which, corroborated by further trial of a practical nature, places the success of the principle, to our minds, beyond a doubt.

In endeavouring to introduce an improvement in navigation so much needed, and in the success of which so great an interest, both private and public, is at stake, we have been at some pains to ascertain the respective claims of the rival plans, and we find that there is so great a difference in the practical utility and economy of the two as to leave no room for hesitation as to preference.

The screw of the "Archimedes" works in a large square opening in the "dead wood" of the vessel, and requires, if applied to ordinary ships, an entire alteration of the stern, both costly and hazardous as to the strength of the after part of the ship. In addition to this, the screw of the Archimedes is worked at such a great speed (exceeding one hundred revolutions per minute) that the use of a heavy intricate combination of cog-wheels is required to give the necessary velocity, the speed of the Archimedes' engines being thereby actually multiplied five times. Without pretending to mechanical knowledge, we assert confidently that such high speed must be very objectionable in practice, and cannot fail to be attended with loss of power. The excessive velocity of the screw, in particular, must be productive of much wasteful resistance in going through the water. We are supported in this opinion by the result of the late trial of the Archimedes, at Liverpool, against the tug William Gunstan, in which the latter, with engines of less power, turned the Archi-

medes astern at the rate of several miles per hour, against the exerted whole force of her superior engine power.

The transversal ship propeller, which, from its motion being transversely to the line of the keel, is so named in contradistinction to the paddle-wheel, may be applied to any ship without the least alteration to her stern. It consists of a thin broad hoop, made of wrought iron, supported by arms of the same material, and attached to a central shaft, which passes through the run of the ship. To the circumference of the said hoop are attached a series of plates (spiral planes) also of wrought iron, placed at an angle, the whole weighing under 900 pounds; two of these propellers, revolving in contrary directions, one on each side of the sternpost, their axes being supported by iron braces secured thereto. The effect of the current of water produced by the motion of the propeller will, as you properly remark, increase the efficacy of the rudder. The distinguishing feature, however, of the transversal ship-propeller is, that the contrary movement is effected, and the ship propelled at any required speed without the use of cog-wheels; the whole arrangement being extremely simple. The total weight of the machinery for the Clarion, consisting of two engines of 35 horse-power each, boilers, propeller, &c., will not exceed 20 tons. All will be ready to be placed on board by the end of next month.

RUSSELL E. GLOVER.
STEPHEN E. GLOVER.

NEW-YORK, Nov. 20, 1840.

E.

From the "New York Herald."

Progress of Steam-navigation.—A new line of packets to Havana.— By reference to our advertising columns, it will be seen that a new line of steam-packets is to be formed immediately between this port and Havana, to leave on the 5th and 15th of each month. The first steam-packet to leave this port under the arrangement will be the Clarion, which is to be hauled up to-day (January 15) at the Dry Dock, for the purpose of having a steam-engine and Ericsson's patent propeller inserted in her.

This movement will form an entirely new era in steam navigation. The great advantages that the Clarion will have over other vessels are these:—she can proceed on her voyage in a *calm* as well as a *gale;* she can pump herself out if leaky, at the rate of 150 men power per hour; she can also, if struck by lightning, and set on fire (like the Poland) drown the fire out in a very short time, by her powerful engine. Again, furnished with the propelling power, she will always be sure of stays in beating off a lee-shore in heavy weather, when other vessels will have to wear. And,

lastly, the speed of the ship under close reefed top-sails and courses, on the wind, in a heavy sea, and going at the rate of five miles per hour, can be increased to eight, more or less, at the discretion of the commander.

One objection made by merchants may be the expense; but the price depends altogether upon the rate of speed. If a shipmaster is satisfied with four or five miles, to keep him off the rocks and shoals, when bound to New-Orleans, the propeller will cost but a small sum. But, if necessary, speed and expense can be increased to almost any extent. Another important advantage, connected with this movement is, in case of a sudden war, the city of New-York could produce, in ninety nays, more war steamers than all Europe combined. If all our splendid packet-ships, such as the Roscius, Russell Glover, &c., had guns on board they would be vessels of war; and if the Ericsson Transversal Propeller were added, they would be converted into war-steamers. - None of an enemy's shot could touch the machinery, as the whole is many feet below the surface of water. Thus the United States can put to sea more steam fighting ships in ninety days, than there are now afloat in Europe already.

Captains Russell and Stephen Glover are now about to bring this plan before the public, by rigging their packet Clarion with Ericsson's Propeller, and if this movement succeeds, it will create a greater sensation than any thing that has occurred for many years. The Clarion is now considered to be a fast sailer under her canvas; she is one of three which are to be put in the Havana line; and we understand Capt. Glover will command the first ship, on account of giving the propeller another trial, before he introduces it into his larger vessels.

Should we thus succeed in successfully combining steam power with canvas, we shall never again see a Liverpool steamer put back for fuel. Modern steam-ships, with paddles larboard and starboard, are liable to powerful objections; when the ship is under a heavy press of canvas, and rather light on the wind, she heels over at an angle of 45 degrees; this brings the lee wheel under water, and the weather one out, consequently the whole propelling power is lost. But on Ericsson's plan, a ship's way in that state, would not be checked, because her two propellers under her stern, would be constantly urging her forward.

The Clarion will only require to have two small holes cut in her stern, for the propellers; and her engine put in; and will be ready for sea by the 5th of February next. We look with great anxiety for the result, and are pleased to find that the enterprising projectors have taken out a patent right for this invention both in Europe and this country; and a Canadian company have purchased the right to use it on our extensive Northern lakes.

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